On the Ammonia Proportional Counter

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could be neglected, only those of Ag^{108} with 2.3 minutes half-life were measured. A distance between an effective volume of the counter and an upper surface of a sample was chosen always as 7.3 mm. Thus, we obtained a curve of specific activity *versus* thickness of samples.

In order to know the effect of the absorption of neutrons in samples, we covered samples by silver discs of various thicknesses. Thus we obtained the following experimental expression:

$$I=\tfrac{1}{2}I_0(e^{-kx}+e^{-k(x_0-x)}) \tag{1}$$

where x_0 was a thickness of a sample, I was the intensity of activities at the depth of x, I_0 was that without absorption, and k was an absorption coefficient of neutrons and, in our case, was found to be 0.00202 (mg./cm^2.)$^{-1}$.

The self-absorption of β-rays in a sample was obtained by the ordinary external absorption experiment. The result was expressed by

$$I=I_0 e^{-ax}, \tag{2}$$

where a was an absorption coefficient of β-rays and found to be 0.0112 (mg./cm^2.)$^{-1}$.

Finally, we put silver discs of various thicknesses beneath the thinnest sample as backings. By a simple assumption, this curve of backscattering was expressed by the form

$$I=I_0\left\{1+\beta(1-e^{-2ax})\right\}, \tag{3}$$

where a was the same as in Eq. (2), and β was a constant. This expression showed a good agreement with the experiment with $\beta=0.367$.

From Eqs. (1), (2) and (3), we obtained the expression for a curve of specific activity *versus* thickness of samples as follows:

$$S=\frac{I}{x_0}=\frac{1}{x_0}\frac{1}{2}\int_0^{x_0}(e^{-kx}+e^{-k(x_0-x)})\,e^{-ax}\left\{1+\beta(1-e^{-2a(x_0-x)})\right\}dx, \tag{4}$$

where S was specific activity.

Eq. (4) was found to agree with the experiment within an error of 3 percent.

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3. On the Ammonia Proportional Counter

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We have investigated the properties of an ammonia proportional counter.

Ammonia gas was supplied by heating commercial aqueous ammonia and sufficiently dehydrated in the potassium hydroxide drying vessel for about 24 hours.

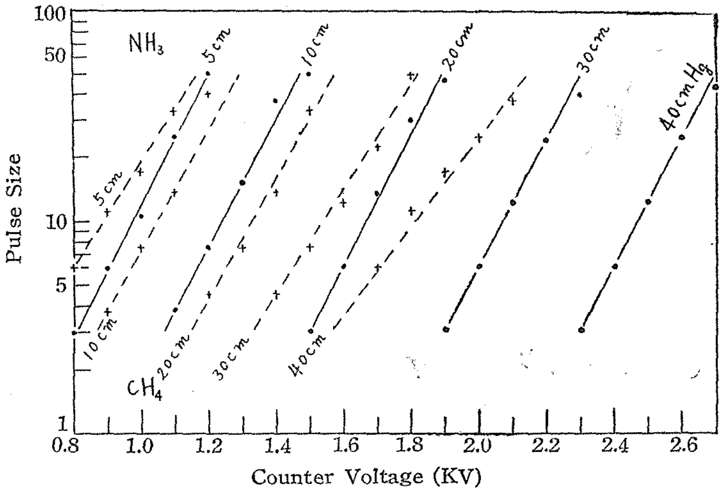

Fig. 1. Pulse size (arbitrary units) against counter voltage for the pressures of 5, 10, 20, 30, and 40 cm. Hg respectively. Solid and dotted lines represent the experimental curves for ammonia and methane counter respectively.

The relation of pulse height and counter voltage was observed for the pressure of 5, 10, 20, 30 and 40 cm.Hg, by introducing a collimated beam of ThC′ α-particles through a thin mica window of about 2 mg./cm^3. in thickness.

This relation can be represented as a straight line in the semi-logarithmic scale similarly to other counters and its slope is such that the pulse height increases by a factor of about two when the counter voltage is increased by one hunered volts. (See Fig. 1).

This slope seems to be slightly larger as compared with the methane counter. Moreover, the threshold voltage of our counter is somewhat higher than that of methane counter.

The ammonia counter is also sensitive both to fast and thermal neutrons. For fast neutron, recoil proton is produced from hydrogen atom in ammonia. The counting efficiency for a few Mev neutron is calculated to be about 0.2% for the counter of 6 cm. in inner diameter and 15 cm. in sensitive length which is filled at the pressure of one atmosphere. For thermal neutron, the 0.6 Mev proton is emitted from the (n, p) reaction of nitrogen.

Its counting efficiency seemes to be nearly equal to the case of fast neutron.

These efficiencies will be able to be increased in the ammonia counter of higher pressure.

More precise experiments are now in progress.